PUBLIC SAFETY OFFICER AVERAGE BUSY HOUR TRAFFIC PROFILE PRESENT REQUIREMENTS SUMMARY	Inbound Erlangs	Outbound Erlangs
VOICE	0.0073484	0.0462886
DATA	0.0004856	0.0013018
STATUS	0.0000357	0.0000232
Resulting Subscriber Busy Hour Traffic Loading	0.0078696	0.0476136
	TOTAL	0.0554832

PUBLIC SAFETY OFFICER AVERAGE BUSY HOUR TRAFFIC PROFILE FUTURE REQUIREMENTS SUMMARY	Inbound Erlangs	Outbound Erlangs
VOICE	0.0073284	0.0463105
DATA	0.0030201	0.0057000
STATUS	0.0001540	0.0002223
Resulting Subscriber Busy Hour Traffic Loading	0.0105026	0.0522328
	TOTAL	0.0627354

PUBLIC SAFETY OFFICER AVERAGE HOUR TRAFFIC PROFILE PRESENT REQUIREMENTS SUMMARY	Inbound Erlangs	Outbound Erlangs
VOICE	0.0018371	0.0115722
DATA	0.0001214	0.0003254
STATUS	0.0000089	0.0000058
Resulting Subscriber Average Hour Traffic Loading	0.0019674	0.0119034
	TOTAL	0.0138708

PUBLIC SAFETY OFFICER AVERAGE HOUR TRAFFIC PROFILE FUTURE REQUIREMENTS SUMMARY	Inbound Erlangs	Outbound Erlangs
VOICE	0.0018321	0.0115776
DATA	0.0007550	0.0014250
STATUS	0.0000385	0.0000556
Resulting Subscriber Average Hour Traffic Loading	0.0026256	0.0130582
	TOTAL	0.0156838

PUBLIC SAFETY OFFICER AVERAGE BUSY HOUR TRAFFIC PROFILE FUTURE REQUIREMENTS SUMMARY (SPECIAL DATA)	Inbound Erlangs	Outbound Erlangs
SPECIAL DATA	0.0268314	0.0266667
Resulting Subscriber Busy Hour Traffic Loading	0.0268314	0.0266667
	TOTAL	0.053498

PUBLIC SAFETY OFFICER AVERAGE HOUR TRAFFIC PROFILE FUTURE REQUIREMENTS SUMMARY (SPECIAL DATA)	Inbound Erlangs	Outbound Erlangs
SPECIAL DATA	0.0067078	0.0066667
Resulting Subscriber Busy Hour Traffic Loading	0.0067078	0.0066667
	TOTAL	0.0133745

Public Safety Officer
Busy Hour Traffic Profile
FUTURE REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading							
		INBOUND				OUTBOUND			
		Tn	Td	M	OFFERED LOAD (erlangs)	Tn	Td	M	OFFERED LOAD (erlangs)
VOICE (Note 1)									
Group	Special Info/Assign	2	2.00	1.260	0.0014000	2	2.00	1.385	0.0015385
	Medical Detail	2	2.00	0.009	0.0000104	2	2.00	0.009	0.0000104
	Bomb/Explosive Alert	2	2.00	0.009	0.0000104	2	2.00	0.009	0.0000104
	Conduct Investigation	2	2.00	0.210	0.0002333	2	2.00	0.231	0.0002564
Individual	Special Info/Assign	2	4.80	0.840	0.0022400	2	2.50	0.923	0.0012821
	Medical Detail	2	2.50	0.019	0.0000259	2	1.25	0.021	0.0000142
	Conduct Investigation	2	4.80	0.105	0.0002800	2	2.50	0.115	0.0001603
	Traffic Report	2	2.50	0.210	0.0002917	2	1.25	0.210	0.0001458
	Bomb/Explosive Alert	2	2.50	0.005	0.0000065	2	1.25	0.005	0.0000032
	Emergency	2	2.50	0.009	0.0000130	2	1.25	0.009	0.0000065
	Vehicle Report	2	6.00	0.525	0.0017500	2	2.50	0.525	0.0007292
	Persons Report	2	6.00	0.315	0.0010500	2	2.50	0.315	0.0004375
Broadcast	Special Info/Assign	1	3.00	0.009	0.0000078	1	6.00	0.009	0.0000156
	Emergency	1	3.00	0.004	0.0000029	1	6.00	0.004	0.0000058
	Bomb/Explosive Alert	1	3.00	0.005	0.0000039	1	1.00	0.005	0.0000013
Hazardous Material		2	2.00	0.0004	4.44E-07	2	2.00	0.004	0.0000044
EMS Control and General	Public Safety Reports	2	10.00	0.0004	2.22E-06	2	10.00	0.004	0.0000222
PSTN	Special Info/Assign	2	10.00	0.0000100	0.0000001	2	12.00	0.0000100	0.0000001
Unit-to-Unit	Tactical	0	0.00	0.000	0	3	20.00	2.500	0.041667

Public Safety Officer
Busy Hour Traffic Profile
FUTURE REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading							
		INBOUND				OUTBOUND			
		Tn	Td	M	OFFERED LOAD (erlangs)	Tn	Td	M	OFFERED LOAD (erlangs)
Total Contributions		**33**	**70.60**	**3.535**	**0.0073284**	**36**	**80.00**	**6.283**	**0.0463105**
DATA (Note 2)									
Hazardous Material		1	1.00	0.004	0.0000011	1	1.00	0.004	0.0000011
EMS Control and General	Public Safety Reports	1	5.00	0.004	0.0000056	1	5.00	0.004	0.0000056
	Missing	1	0.80	0.068	0.0000150	1	2.40	0.068	0.0000450
	Unidentified	1	0.80	0.270	0.0000600	2	2.40	0.270	0.0003600
Stolen Articles	License Plate	1	0.80	0.135	0.0000300	2	2.40	0.135	0.0001800
	Serial Number	1	0.80	0.036	0.0000081	2	2.40	0.036	0.0000486
	Identification Number	1	0.80	0.090	0.0000201	1	2.40	0.090	0.0000603
Alarm Compliance	Burglary	1	0.80	0.036	0.0000081	1	2.40	0.036	0.0000243
	Ringing	1	0.80	0.018	0.0000039	1	2.40	0.018	0.0000117
	Vandalism	1	0.80	0.068	0.0000150	1	2.40	0.068	0.0000450
	Robbery	1	0.80	0.068	0.0000150	1	2.40	0.068	0.0000450
For Information (FI)	Suspicious Persons	1	2.40	4.000	0.0026667	1	4.00	4.000	0.0044444
Addr/Tel Info (ATI)	Suspicious Persons	1	1.60	0.386	0.0001716	1	4.00	0.386	0.0004290
Voiceless Dispatch	(see voice)								
Total Contributions		13	17.20	5.183	0.0030201	16	35.60	5.183	0.0057000

Public Safety Officer
Busy Hour Traffic Profile
FUTURE REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading							
		INBOUND				OUTBOUND			
		Tn	Td	M	OFFERED LOAD (erlangs)	Tn	Td	M	OFFERED LOAD (erlangs)
STATUS	Special Info/Enroutes	1	0.03	6.000	0.0000500	1	0.03	3.000	0.0000250
	Network Management	1	0.80	0.420	0.0000933	1	1.60	0.420	0.0001867
SYSTEM CONTROL									
Security	Registration								
	Authentication	1	1.03	0.009	0.0000027	1	1.03	0.009	0.0000027
	Corroboration	1	3.09	0.009	0.0000080	1	3.09	0.009	0.0000080
Total Contributions		4	4.95	6.439	0.0001540	4	5.75	3.439	0.0002223

TELESERVICES	OPERATIONS	INBOUND				OUTBOUND			
SPECIAL DATA		Tn	Td	M	OFFERED LOAD (erlangs)	Tn	Td	M	OFFERED LOAD (erlangs)
Slow Scan		1	100.00	0.060	0.001667	1	100.00	0.060	0.0016667
Images	Mugshot	1	30.0	1.000	0.0083333	1	30.0	1.000	0.0083333
	Fingerprint	1	30.0	1.000	0.0083333	1	30.0	1.000	0.0083333
	Object ID	1	30.0	1.000	0.0083333	1	30.0	1.000	0.0083333
Total Contributions		4	190.00	3.060	0.0268314	4	190.00	3.060	0.0266667

Public Safety Officer
Busy Hour Traffic Profile
PRESENT REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading							
		INBOUND				OUTBOUND			
		Tn	Td	M	OFFERED LOAD (erlangs)	Tn	Td	M	OFFERED LOAD (erlangs)
VOICE (Note 1)									
Group	Special Info/Assign	2	2.00	1.260	0.0014000	2	2.00	1.385	0.0015385
	Medical Detail	2	2.00	0.009	0.0000104	2	2.00	0.009	0.0000104
	Bomb/Explosive Alert	2	2.00	0.009	0.0000104	2	2.00	0.009	0.0000104
	Conduct Investigation	2	2.00	0.210	0.0002333	2	2.00	0.231	0.0002564
Individual	Special Info/Assign	2	4.80	0.840	0.0022400	2	2.50	0.923	0.0012821
	Medical Detail	2	2.50	0.019	0.0000259	2	1.25	0.021	0.0000142
	Conduct Investigation	2	4.80	0.105	0.0002800	2	2.50	0.115	0.0001603
	Traffic Report	2	2.50	0.210	0.0002917	2	1.25	0.210	0.0001458
	Bomb/Explosive Alert	2	2.50	0.005	0.0000065	2	1.25	0.005	0.0000032
	Emergency	2	2.50	0.009	0.0000130	2	1.25	0.009	0.0000065
	Vehicle Report	2	6.00	0.525	0.0017500	2	2.50	0.525	0.0007292
	Persons Report	2	6.00	0.315	0.0010500	2	2.50	0.315	0.0004375
Broadcast	Special Info/Assign	1	3.00	0.009	0.0000078	1	1.00	0.009	0.0000026
	Emergency	1	3.00	0.004	0.0000029	1	1.00	0.004	0.0000010
	Bomb/Explosive Alert	1	3.00	0.005	0.0000039	1	1.00	0.005	0.0000013
Hazardous Material		2	2.00	0.0004	4.444E-07	2	2.00	0.0004	4.444E-07
EMS Control and General	Public Safety Reports	2	10.00	0.004	2.222E-05	2	10.00	0.004	2.222E-05
PSTN	Special Info/Assign	2	7.20	0.0000100	0.0000000	1	7.20	0.0000100	0.0000000

Public Safety Officer
Busy Hour Traffic Profile
PRESENT REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading							
		INBOUND				OUTBOUND			
		Tn	Td	M	OFFERED LOAD (erlangs)	Tn	Td	M	OFFERED LOAD (erlangs)
Unit-to-Unit	Tactical	0	0.00	0.000	0	3	20.00	2.500	0.0416667
Total Contributions		33	67.80	3.538	0.0073484	35	65.20	6.279	0.0462886
DATA (Note 2)									
Hazardous Material		1	1.00	0.004	0.0000011	1	1.00	0.004	0.0000011
EMS Control and General	Public Safety Reports	1	5.00	0.004	0.0000056	1	5.00	0.004	0.0000056
	Missing	1	0.80	0.050	0.0000111	1	2.40	0.050	0.0000333
	Unidentified	1	0.80	0.200	0.0000444	2	2.40	0.200	0.0002667
Stolen Articles	License Plate	1	0.80	0.100	0.0000222	2	2.40	0.100	0.0001333
	Serial Number	1	0.80	0.027	0.0000060	2	2.40	0.027	0.0000360
	Identification Number	1	0.80	0.067	0.0000149	1	2.40	0.067	0.0000447
Alarm Compliance	Burglary	1	0.80	0.027	0.0000060	1	2.40	0.027	0.0000180
	Ringing	1	0.80	0.013	0.0000029	1	2.40	0.013	0.0000087
	Vandalism	1	0.80	0.050	0.0000111	1	2.40	0.050	0.0000333
	Robbery	1	0.80	0.050	0.0000111	1	2.40	0.050	0.0000333
For Information (FI)	Suspicious Persons	1	2.40	0.333	0.0002220	1	4.00	0.333	0.0003700
Addr/Tel Info (ATI)	Suspicious Persons	1	1.60	0.286	0.0001271	1	4.00	0.286	0.0003178
Voiceless Dispatch	(see voice)								
Total Contributions		13	17.20	1.211	0.0004856	16	35.60	1.211	0.0013018

Public Safety Officer
Busy Hour Traffic Profile
PRESENT REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading							
		INBOUND				OUTBOUND			
		Tn	Td	M	OFFERED LOAD (erlangs)	Tn	Td	M	OFFERED LOAD (erlangs)
STATUS	Special Info/Enroutes	1	0.03	3.000	0.0000250	1	0.03	1.500	0.0000125
SYSTEM CONTROL									
Security	Registration								
	Authentication	1	1.03	0.009	0.0000027	1	1.03	0.009	0.0000027
	Corroboration	1	3.09	0.009	0.0000080	1	3.09	0.009	0.0000080
Total Contributions		3	4.15	3.019	0.0000357	3	4.15	1.519	0.0000232

APPENDIX E

Focus Groups Report
Future Data Applications for Public Safety Communications
(D.S. Howard & Associates)

NOTE: ***The electronic version of this document was unavailable at the time this report was prepared. Readers can find the full text of this document in FCC WT Docket No. 96-86.***

APPENDIX F
LOS ANGELES AREA FREQUENCY REUSE

For this paper, the Los Angeles area is the 5 county region of Los Angeles, Orange, Ventura, Riverside, and San Bernardino Counties. The defined area is based upon the local experience showing frequency assignments in Los Angeles County impact the assignments in the surrounding counties. This does not imply that a frequency assignment cannot be reused within the area, only that assignments must be coordinated as a total area.

The Association of Public-Safety Officials-International (APCO) local frequency advisors maintain a database of frequency assignments to agencies in this region. This database tracks each public safety agency licensed on a frequency. This database was used for 150 MHz and 450 MHz band reuse. The NPSPAC Region 5 frequency assignment list, excluding mutual aid channels, was used for reuse factors for the NPSPAC 800 MHz assignments.

The assignments (or licenses) at 150 MHz and 450 MHz are typically made to smaller agencies. The NPSPAC assignments are typically made on a county-wide basis for regional multi-agency systems. This indicates the smallest reuse on the NPSPAC frequencies, although a frequency may be reused more than once in a regional system. At 150 MHz, the assignments are on an individual frequency basis. At 450 MHz and 800 MHz, the assignments are for a channel (two paired frequencies). The complete listing of assignments was used for the NPSPAC reuse factors and a sampling of frequencies was used at 150 MHz and 450 MHz.

The average reuse is listed below:

	Assignments	**Frequencies**	**Average Reuse**
150 MHz	81	24	3.4
450 MHz	31	11	2.8
800 MHz	300	216	1.39

The reuse pattern is explained by the history of frequency assignments in the area. The 150 MHz band was the primary band for most users. The 450 MHz band and later TV sharing bands were allocated and the larger agencies tended to migrate to these bands. Some smaller agencies also operate in the UHF bands. The 800 MHz bands are licensed almost entirely to large agencies with many systems serving several agencies or departments as consolidated systems. These reuse figures reflect this history with many geographically small users at 150 MHz, fewer medium-sized users at 450 MHz, and a few large users at 800 MHz.

These assignments are for voice dispatch systems and a few mobile data systems. Mobile data systems, while only a minority of the assignments and primarily used by larger agencies, are configured to cover the same geographical areas as a voice system for any particular agency. Mobile data systems can handle more units on a channel than voice. Geographically larger mobile data systems have some reuse because the channel can send data to different units (one to one, rather than the one to many configuration for voice) from separate sites simultaneously. Other services, such as snapshot and slow scan video are extensions of the current mobile data systems. They can operate on existing mobile data systems, possibly

needing higher data rates. The reuse of frequencies for these services may be greater than for voice systems.

Full motion video systems require more bandwidth for the higher data rates required. The hold times are longer than voice systems. These factors differ from voice systems but do not influence the reuse of frequencies designated for video systems. As a new service, video systems should follow the implementation history of mobile data systems with implementation by larger agencies first. Considering the infrastructure costs, there will be incentives for smaller agencies to join large regional systems. This argues for a reuse pattern similar to other large mobile data systems.

The last issue is the reuse spread of 1.39 for 800 MHz to 3.4 for 150 MHz. Public safety agencies operating in the 150 MHz band are typically small single users, such as a city fire department or a special district. The band still has many simplex systems with mobile only frequencies. Many users would like to upgrade to mobile relay systems. The 450 MHz band is a mix of medium and large agencies. This mix is the prime reason for lower reuse in this band than 150 MHz. Both bands are quite crowded with interference problems between users. The 800 MHz band is typically assigned for large county-wide systems. There is some reuse within the systems and not reflected in the assignment list.

What should the reuse factor be in the spectrum prediction model? For voice systems, a middle factor using the 450 MHz band is reasonable. It should be reduced to account for the crowding in the band. A factor of 2.5 is proposed for voice systems. This same factor will apply to slow data (including status/message). These categories are typically configured the same as voice systems.

A reuse factor for high speed data systems (special data) is more difficult to determine. If it is assumed there is some inherent additional reuse in high speed data systems due to the one to one communications rather than the one to many found in the voice systems, a factor higher than 2.5 is appropriate. A factor of 3.4 could be used which reflects the highest reuse found in today's systems. However, these high speed data systems are not installed today so there can be better planning for reuse to reflect the one to one nature of the communications. In urban areas, it is probable that higher frequencies will be used to build these systems, allowing smaller footprints and thus higher reuse. However, this reuse will not approach cellular system reuse factors. Public safety systems are designed to cover operational areas of the agencies. Another critical distinction between cellular systems and public safety data systems is the significantly higher user density of cellular systems; this, in turn, supports much smaller cell sizes. This does not imply that public safety high speed data systems can alternatively be carried on the cellular network. Given all these factors, a reuse factor of 4.0 is proposed as reasonable for high speed data.

APPENDIX G

SPECTRUM COMPUTATION FOR NON-FEDERAL PUBLIC SAFETY

FREQ. MHz = ERL*(10000*POP*PEN*SRC)/(COD*RATE*LOAD*REUS*[100-ERR])

SPECTRUM COMPUTATION FOR POLICE THROUGH THE YEAR 2010

	Avg ERL/User	POP in thou.	PEN,%	Computed Net Pop, thous.	SRC,kb/s	COD	RATE b/s/Hz	LOAD,%	REUS	ERR,%	Computed MHz in 2010
Voice	0.0538	89.4	65	58.11	6	2	1.5	54.5	2.5	50	9.2
Data	0.0087	89.4	35	31.29	6	1	1.5	54.5	2.5	50	1.6
Stat/Messg	0.0004	89.4	31	27.71	6	2	1.5	54.5	2.5	50	0.0
W.B. Data	0.0140	89.4	23	20.56	384	3	3.5	54.5	4	50	9.7
Video	0.0240	89.4	14	12.52	384	3	3.5	54.5	4	50	10.1

SPECTRUM COMPUTATION FOR FIRE THROUGH THE YEAR 2010

	Avg ERL/User	POP in thou.	PEN,%	Computed Net Pop,thous.	SRC,kb/s	COD	RATE b/s/Hz	LOAD,%	REUS	ERR,%	Computed MHz in 2010
Voice	0.0484	164.7	51	84.00	6	2	1.5	54.5	2.5	50	11.9
Data	0.0087	164.7	27	44.47	6	1	1.5	54.5	2.5	50	2.3
Stat/Messg	0.0004	164.7	31	51.06	6	2	1.5	54.5	2.5	50	0.1
W.B. Data	0.0140	164.7	28	46.12	384	3	3.5	54.5	4	50	21.7
Video	0.0240	164.7	20	32.94	384	3	3.5	54.5	4	50	26.5

SPECTRUM COMPUTATION FOR EMS THROUGH THE YEAR 2010

	Avg ERL/User	POP in thou.	PEN,%	Computed Net Pop,thous.	SRC,kb/s	COD	RATE b/s/Hz	LOAD,%	REUS	ERR,%	Computed MHz in 2010
Voice	0.0484	55.8	47	26.23	6	2	1.5	54.5	2.5	50	3.7
Data	0.0087	55.8	45	25.11	6	1	1.5	54.5	2.5	50	1.3
Stat/Messg	0.0004	55.8	34	18.97	6	2	1.5	54.5	2.5	50	0.0
W.B. Data	0.0140	55.8	31	17.30	384	3	3.5	54.5	4	50	8.1
Video	0.0240	55.8	17	9.49	384	3	3.5	54.5	4	50	7.6

SPECTRUM COMPUTATION FOR GENERAL GOVERNMENT THROUGH THE YEAR 2010

	Avg ERL/User	POP in thou.	PEN,%	Computed Net Pop,thous.	SRC,kb/s	COD	RATE b/s/Hz	LOAD,%	REUS	ERR,%	Computed MHz in 2010
Voice	0.0430	269.8	22	59.36	6	2	1.5	54.5	2.5	50	7.5
Data	0.0087	269.8	1	2.70	6	1	1.5	54.5	2.5	50	0.1
Stat/Messg	0.0004	269.8	16	43.17	6	2	1.5	54.5	2.5	50	0.1
W.B. Data	0.0140	269.8	1	2.70	384	3	3.5	54.5	4	50	1.3
Video	0.0240	269.8	3	8.09	384	3	3.5	54.5	4	50	6.5

PUBLIC SAFETY WIRELESS ADVISORY COMMITTEE
September 11, 1996

SPECTRUM COMPUTATION FOR PUBLIC SAFETY THROUGH THE YEAR 2010

	POLICE	FIRE	EMS	GEN. GOVT	TOTAL
Voice	9.2	11.9	3.7	7.5	32.3
Data	1.6	2.3	1.3	0.1	5.3
Stat/Message	0.0	0.1	0.0	0.1	0.2
W.B. Data	9.7	21.7	8.1	1.3	40.8
Video	10.1	26.5	7.6	6.5	50.7
TOTAL	30.6	62.5	20.7	15.5	129.3
EXISTING SPECTRUM USED IN 2010					-23.4
SPECTRUM PROVIDED BY COMMERCIAL SERVICES					-10.6
NET SPECTRUM NEED BY 2010					95.3

APPENDIX H

Department of Defense Comments
(Office of the Assistant Secretary of Defense Letter - July 18, 1996)

*NOTE: **The electronic version of this document was unavailable at the time this report was prepared. Readers can find the full text of this document in FCC WT Docket No. 96-86.***

APPENDIX I

PUBLIC SAFETY FIXED SERVICE SPECTRUM REQUIREMENTS

To determine the amount of additional spectrum required by public safety for fixed services through the year 2010, an analysis was completed using the Los Angeles area. The State of California, the County of Los Angeles, and the City of Los Angeles each submitted microwave growth requirement through the year 2010. The results are representative of metropolitan areas as the requirements were based upon population, terrain, density, and extensive need for wireless carrier systems. The following discussion relates to identified needs in the Los Angeles area only.

Projections from the agencies listed above are based on past growth and projected future growth. This analysis includes considerations for new technology. New applications will certainly add to growth projections in the near future. Because there is no specific way to quantify the effect of new applications, spectrum for non-identified purposes is not included.

Based on growth projections, the State of California identifies a need for 68 new digital microwave links. Also, 31 links for the County of Los Angeles, 27 links for Los Angeles City, and 20 links to serve the more than 100 incorporated cities within a 30-mile radius of the Los Angeles Civic Center were identified. In a heavily populated area such as Los Angeles, there is a large capacity (i.e., channel) requirement.

Listed below are the link and band requirements. These requirements were used to calculate the microwave spectrum requirements.

AGENCY	CAPACITY
California State	20 DS3
Los Angeles County	31 DS3
Los Angeles City	26 DS3
	11 OC3
100+ Los Angeles Cities	56 DS1
	21 DS2
	6 DS3
	3 OC3

PATH LENGTH

CALIFORNIA STATE		20 DS3	
11% =	2 links	< 16 KM	≤18 GHz≥ 6 GHz
	18 links	> 16 KM	≤ 6 GHz

LA COUNTY		**31 DS3**	
	6 links	< 16 KM	≤ 18 GHz
	25 links	> 16 KM	≤ 6 GHz
100 LA CITIES			
56 DS1		< 16 KM	≤ 18 GHz
21 DS2		11	< 18 GHz
6 DS3		11	≤ 19 GHz
3 OC3s		11	< 11 GHz
LA CITY		**26 DS3**	
60%	16 links	≤ 16 KM	≤ 6 GHz
40%	10 links	≤ 16 KM	≤ 18 GHz
	(11 OC3)		
	6 links	≥ 16 KM	≤ 6 GHz
	5 links	≤ 16 KM	< 20 DS3

BANDS

	2-8 GHz	10-18 GHz
(a) **LA CITY**	16 DS3 6 OC3	10 DS3 5 OC3
(b) **LA CITIES**		3 OC3} 6 DS3} 21 DS2} 20 DS3 56 DS1}
(c) **CAL STATE**	18 DS3	2 DS3
(d) **LA COUNTY**	25 DS3	6 DS3

A 30-mile radius from the Los Angeles Civic Center was used in calculating the reuse factor. This area was selected as it is the most congested within the greater Los Angeles area, and will continue to have the highest channel loading requirements. Using the FCC's third party database, an inventory of all 6500 MHz to 6900 MHz microwave systems within a 30-mile radius of the Civic Center was completed. This analysis was made to determine what a realistic reuse factor is, based upon real data.

$$\text{Spectrum} = \frac{\text{Links} * \text{BW} * 2}{\text{Reuse Factor}}$$

Using data from the existing 6 GHz (heavily congested) data base for Los Angeles, the reuse factor is 11.8(x12) for this calculation.

NON-FEDERAL PUBLIC SAFETY SPECTRUM REQUIREMENTS

2-8 GHz

$$\text{65 DS3 Spectrum} = \frac{65*20}{12} = 108.3 \text{ MHz}$$

A higher reuse factor for bands ranging from 10-18 GHz was chosen because the higher frequencies had shorter propagation (even though the lower portion of this range, 11-12 GHz, travels over 30 miles). A factor of 20 was considered reasonable.

10-18 GHz $\qquad$ $\text{Spectrum} = \frac{53*20}{20} = 53 \text{ MHz}$

This analysis indicates a total of 161.3 MHz (108.3 MHz + 53 MHz) is required through the year 2010. This recommendation should accommodate other metropolitan areas; less populated areas should require somewhat less additional microwave spectrum.

EXISTING MICROWAVE ALLOCATION SHARED/PUBLIC SAFETY

BAND (MHz)	SHARED BANDWIDTH AVAILABLE	PUBLIC SAFETY LICENSES	PUBLIC SAFETY BANDWIDTH
900	13 MHz	3/31 = 10%	1.3 MHz
2130-2150	20 MHz	19/57 = 33%	6.6 MHz
2180-2200	20 MHz	18/55 = 33%	6.6 MHz
3720-4100	380 MHz	0/7 = 0%	0
5927-6425	498 MHz	18/233 = 8%	40 MHz
6525-6875	350 MHz	245/408 = 60%	210 MHz
10550-10680	130 MHz	45/167 = 27%	35 MHz
10700-11700	1000 MHz	23/179 = 13%	130 MHz
17705-18120	450 MHz	68/130 = 52%	234 MHz

BAND (MHz)	SHARED BANDWIDTH AVAILABLE	PUBLIC SAFETY LICENSES	PUBLIC SAFETY BANDWIDTH
18762.5-18817.5	55 MHz	26=50% 52	26 MHz
19102.5-19157.5	55 MHz	20=48% 41	26 MHz

Total Existing Public Safety Microwave Spectrum = 715 MHz

To demonstrate that public safety users are aware of the need to conserve spectrum wherever possible, we compared the ratios of the existing microwave spectrum used by public safety to the spectrum now allocated for voice and data to the new requirements ratio of the same, i.e., present microwave spectrum used by public safety (715 MHz) divided by the present voice/data allocation (23 MHz) = 31.08. Future microwave spectrum required (161 MHz) divided by the future voice/data/video spectrum requirements (95 MHz) = 1.7.

The comparison of these ratios demonstrates the amount of microwave spectrum required for public safety through 2010 is ver conservative; 18 times less than that used by today.

All presently allocated links to which public safety has access are heavily used in the 30-mile radius of the Los Angeles area that was used for this case study. There is a growing demand for the microwave spectrum that is still available in the defined area, including numerous new users such as local and long distance PCS providers, telephone carriers, and cellular providers. It is becoming virtually impossible to license new microwave spectrum.

Another reason for the scarcity of microwave spectrum is that public safety has lost the use of the 1850-1990 MHz band to PCS and the 12.2-12.7 GHz band to Direct Broadcast Satellite systems, a loss of 190 MHz of spectrum. There is also a threat of losing an additional 40 MHz in the 2130-2150 MHz and 2180-2200 MHz bands. The common carrier bands that were made available to public safety to help with the spectrum losses to PCS are extremely congested and will soon be fully utilized as the users in the 1850-1990 MHz are forced to relocate.

This study and the requirements for the microwave spectrum for state and local public safety considered the use of fiber optics and commercial wire lines. These services are being used now and will continue to be used wherever it is practical and not cost-prohibitive. Use of fiber optic links to most mountain top locations where base stations and repeaters are located is cost-prohibitive, has serious right-of-way problems, and is susceptible to earthquakes to fires and flooding (especially in California). High reliability of links is essential to public safety; outages usually affect many circuits and cannot be tolerated.

As an example of fiber optics use, Los Angeles County is presently utilizing 48 DS3 and 12 OC3 fiber links. By the year 2010, they are planning to use 500 DS3 and 150 OC3 links. Agencies such as the City of Los Angeles, the State of California, and other cities presently use fiber and have similar plans for the future.

Assuming the use of commercial wirelines, fiber optics, and new technology, a very aggressive reduction of microwave usage by the year 2010 is projected. The following time frame for required 161 MHz of additional microwave spectrum is provided:

TIME	ADDITIONAL SPECTRUM REQUIREMENTS
Present through 1999	75 MHz
2000 - 2005	50 MHz
2006 - 2010	36 Mhz

APPENDIX J

White Paper:
Frequency Band Selection Analysis
(Motorola)

NOTE: ***The electronic version of this document was unavailable at the time this report was prepared. Readers can find the full text of this document in FCC WT Docket No. 96-86.***

APPENDIX K

Department of Defense Comments
(Letter dated July 29, 1996)

NOTE: ***The electronic version of this document was unavailable at the time this report was prepared. Readers can find the full text of this document in FCC WT Docket No. 96-86.***

6.5 APPENDIX E - Transition Subcommittee Report
FINAL REPORT OF THE TRANSITION SUBCOMMITTEE
Date: July 5, 1996

1.0 Executive Summary.

Other PSWAC Subcommittees have made recommendations regarding the future operational requirements of public safety agencies, methods for achieving greater interoperability among agencies, the technologies that are and will be available to meet public safety requirements, and the amount of radio spectrum that will be necessary to accomplish these public safety goals. This Transition Subcommittee report examines and proposes procedures for public safety agencies to transition to new technologies and new spectrum in an efficient, cost effective manner that does not interfere with their mission critical operations.

Any significant transition will require public safety agencies to acquire new radio equipment and possibly modify their operations and spectrum management. The Transition Subcommittee proposes incentives for agencies to make those changes within a reasonable time frame, but with minimum disruption.

Public safety radio systems in frequencies below 512 MHz now operate in a shared frequency environment, though careful frequency coordination has allowed for a significant degree of de facto exclusivity to avoid harmful interference to vital emergency communications. The Subcommittee proposes that public safety licensees be granted formal, exclusive licenses for a Protective Service Area limited to the licensee's area of jurisdiction. With such exclusivity, licensees are more likely to expend resources to adopt new technologies.

The FCC has adopted "spectrum refarming" rules to encourage the use of narrowband radio equipment in bands below 512 MHz which, for example, allows current 25 kHz wide channels to be split into at least two 12.5 kHz channels, and eventually into four 6.25 kHz channels. The benefits of refarming, however, will not be realized until a substantial number of users acquire new radio systems capable of operating in the narrower channels.

To facilitate the transition to narrower channels, the Transition Subcommittee believes that current metropolitan area public safety users should be required to convert to more spectrum efficient equipment by the year 2005. This will allow users to realize the useful life of current equipment, without creating a situation in which one small agency prevents others from enjoying the benefits of spectrum efficient technology. The approach recommended by the Transition Subcommittee is also consistent with the migration plan adopted by NTIA for Federal Government users.

Coordinating use of new narrower channel operation will require adoption of technical standards for evaluating potential co-channel and adjacent channel interference. The Subcommittee urges the FCC to consider adoption of standards recently proposed in this regard by TIA TR8 Working Group 8.8.

The Transition Subcommittee believes that effective spectrum management of current operations below 512 MHz can best be accomplished through the current public safety radio services (Police, Fire, Local Government, Emergency Medical, Highway Maintenance, and Forestry Conservation). However, should the FCC proceed with its plan to consolidate these radio services, the Subcommittee believes that there should be a separate Public Safety Pool containing all of these services, with frequency coordination performed by the current public safety coordinators, each serving their own constituency.

The Transition Subcommittee also supports the use of intensive regional spectrum planning for congested metropolitan areas, and more generic planning approaches for rural areas. Another important method of achieving spectrum efficiency and interoperability is the creation of wide-area, multi-agency communications systems. While there should be encouragement and perhaps incentive for agencies to form such consolidated operations, shared systems will only succeed with the cooperation and consent of participating agencies. Therefore, system consolidation should be on a voluntary basis with appropriate recognition of the need to maintain local autonomy.

The Subcommittee also addressed the process of implementing new public safety spectrum allocations. How that transition will occur will depend upon factors such as which spectrum bands are targeted, the propagation characteristics of the bands, the type of technologies being implemented, the cost of the new operation, the types of infrastructure that will be required, whether the new spectrum will be shared by federal and non-federal users, and whether the new bands are encumbered by current non-public safety users.

A key issue in any transition will be how public safety agencies will raise sufficient funds to acquire new equipment. The Subcommittee explored several options, including traditional federal, state, and local funding, as well as more innovative funding mechanisms.

The Subcommittee also believes that there is a need for greater cooperation between federal and non-federal regulatory agencies to facilitate more efficient use of spectrum. FCC and NTIA rules need to be modified to facilitate sharing, and there needs to be a mechanism for greater information exchange between federal and non-federal users as to which bands and which locations are viable for spectrum sharing.

It is apparent that commercial services are likely to play an increasingly important role in the future. Nevertheless, the Subcommittee believes that the vast majority of public safety radio communications will necessarily remain on "private radio" systems owned and operated by public safety agencies. For most critical public safety communications, commercial services will not provide a sufficient level of coverage, reliability, restoration, priority access and security.

2.0 Transition Subcommittee Charter Overview.

2.0.1 The migration to new technologies and new spectrum allocations for public safety use involves a host of technical, licensing, interoperability, and funding issues. The